THE VIEWS OF A SCIENTIST

Interesting and Timely Facts from a Report on Natural Gas by Dr. Phinney.

Developments of the Fields in This State Have Been Prolific in Great Results—The Drillings and Permanency of Supply.

A very interesting and practical report to the United States Geological Survey by Dr. A. J. Phinney, contains not the theories but the facts that have been revealed by the natural-gas drillings in Indiana. An abstract of its record, as prepared by the Journal's Washington correspondent, gives most of the principal drillings in the State. While there is yet much to learn, the report states, it may be said that the developments during the last two years have been prolific in results. Formations that were before unknown or wrongly identified have been determined, and their limits approximately marked out. The preliminary geological map which accompanies the report, while only claimed to be approximately correct, is a great improvement on any previously published. The most interesting feature of the report, however, is the size and production of the gas area. It is impossible to give exact figures, as the gas area is spotted on the eastern, southeastern and southern borders, owing to the porous rock being in patches or narrow strips, with compact rock between, while on the west, northwest and north the exact borders are as ill-defined, owing to the local swells in the Trenton limestone that contains gas, while the intervening depressions contain salt water. It is hardly probable, however, that the estimates given showing that the gas flow in Indiana covers 2,525 square miles, will be much changed by future investigations. Sufficient drilling has not been done in Dearborn and DeKalb counties to enable any estimate to be made concerning the area. No other productive area than the Trenton limestone has yet been developed, though a productive field has been opened in Harrison county near the Ohio river, the gas being found there in strata that overly the Devonian black shale. The combined capacity of all the wells, from actual measurements and fair estimates, was, on July last, about 500,000,000 cubic feet per day. Developments since that date will, we are informed, increase that amount to about 650,000,000, perhaps 700,000,000, cubic feet per day. Of the wells a large number show a daily capacity from 1,000,000 to 3,000,000 cubic feet. A large number range from 3,000,000 to 5,000,000, while there is a liberal number with a daily flow of from 5,000,000 to 10,000,000, with a still greater capacity claimed for a few. The daily consumption in the field would probably reach about 200,000,000 cubic feet.

There have been so far very few, if any, failures to obtain gas in any of the wells drilled within what is considered as positively productive territory, though some wells required torpedoing before the flow was obtained. Absolute failures have occurred only around the margins of the field where salt water was struck if the drill tapped the rock at a level too low for the gas or where non-porous rock was found in the higher portions of the field. The topographical map, of the upper surface of the Trenton limestone shows clearly the form of the Cincinnati arch, the dominating structural feature of the State. This arch is the reservoir for the gas and oil which have risen into the highest porous strata. It acts like a great tube with its upper end closed, because of lack of porosity in the rock. Its lower portion, however, is porous and open throughout its whole extent to the Illinois line, as well as on its northern and southern slopes. The gas-bearing porous strata is probably continuous over most of Indiana north of Indianapolis, and also probably in places at least connected with water-bearing strata below. Nearly all the gas and oil that has found its way into the porous strata of the Trenton limestone over nearly all of northern Indiana has found its way into this upper portion of the arch in obedience to the laws that govern the flow of gas, oil and salt water. The gas is in the highest portions, being the lightest, while the oil lies just below, the salt water filling all the remaining porous rock, and everywhere subject to an artesian pressure varying from 300 to 875 pounds per square inch, according to the depth from the surface at which it is struck. Sometimes only a few feet of compact rock intervenes between the gas-bearing strata and a salt-water-bearing strata below.

Owing to the immediate contact between the water and gas, the artesian pressure of the salt water is transmitted to the gas. This pressure, plus the expansive force of the gas itself, equals the rock pressure of the gas, which over the main body of the field is 320 pounds per square inch. Under this pressure 1,000 cubic feet, as measured at the well, would occupy the space of only about fifty cubic feet in the rock. The study of this rock pressure is a very important and practical subject, as the success of piping gas depends upon it. Experience has shown that in piping gas there is a loss, from friction, of from four to five pounds per mile. The effect of this friction is the flaming up of the gas in the well, producing a retained pressure. If a well is turned on full into a main, the loss from friction, plus the pressure indicated by the regulator at the reducing station, equals the retained pressure at the well. Experiments show that a well having a daily capacity of 4,500,000 cubic feet could carry 25 pounds retained pressure and discharge eight-ninths of its capacity; 50 pounds and discharge eleven-fifteenths its capacity; 75 pounds, two-thirds; 100 pounds, five-ninths; 125 pounds, thirteen-forty-fifths its capacity. For retained pressures greater than 125 pounds the diminution is very rapid, though liable to variation from several causes. The stronger the well the greater retained pressure it can carry with the least diminution of its flow, while small wells are practically useless for piping long distances, because of the small amount of gas they can discharge under a high retained pressure.

Where the draught on any portion of the field is very large, unless the rock is very porous, the working rock pressure will be found to fall considerable below 320 pounds. If all the wells were closed the pressure would be 320 pounds, but when all are in use, if one is closed, if a large well, it will show 200 or 250 pounds in one or two minutes. After that time the increase will be slow, and it may require one or two hours to reach its maximum. This does not indicate any failure in the supply. The pressure shown in one or two minutes in a large well is the available working pressure of that portion of the field, and it varies from several causes, but in piping gas all calculations relative to the amount the mains will carry, or the distance to be conveyed, must be based upon it.

As to the origin of natural gas, it is shown in every case to be closely related to rock formations that are heavily charged with organic matter, either animal or vegetable. While porous rocks everywhere contain water it is only under certain conditions that they may contain gas. The St. Peter's sandstone that underlies the Trenton limestone is also in the form of an arch, but it contains nothing but salt water from Michigan to Tennessee, though very porous where the arch is most marked. There is no gas-producing rock beneath it. The restricted area of the gas-bearing rock is a positive indication that the supply is limited and its production practically finished, though the supply may be somewhat replenished by the volatilization of the oil that is present in the rock. All belief in its continued formation, in the interior of the earth, by certain complex chemical reactions that may be supposed to take place will prove a delusion. No man has ever advanced such a theory who had any practical knowledge of the gas and oil fields. Only the chemist who hopes to imitate nature believes such theories. How long the supply will last is a matter of conjecture, as it will depend upon the demands made on the field and the economy practiced in its consumption. The supply is immense, and will probably last a great many years. So far as now known, there have been no failures or decrease in the flow of wells in the main field where properly cared for.

The greatest interest in the natural gas is its practical use as a fuel, not only for household purposes, but for manufacturing as well. Although but little more than two years has elapsed since its first discovery in Indiana, the gas area has already taken its place as a manufacturing district, and from present indications it bids fair to be the most important one in the State. Marion, Kokomo and Muncie have each secured a large number of factories, giving employment to hundreds of men. Anderson is also crowding the other cities just named closely for honors. In all these cities the price of real estate has nearly doubled, while the demand for houses is far in excess of the supply. Among the other cities and towns that are taking on a new life are: Knightstown, Portland, Spiceland, Hagerstown, Tipton, New Castle, Middletown, Pendleton, Dunkirk, Winchester, Redkey, Greenfield, Noblesville, Fairmount, and a host of other towns have caught the spirit of progress. Home industries are springing up in every hamlet, and the farmer even has caught the spirit that desires the best of nature's fuels. One great advantage of the Indiana field is the fact that the manufacturer can sink his well at the very doors of his factory with every assurance of securing a good well, and he can then draw from the fountain of wealth so long as the supply shall last.

Only a Temporary Difficulty.

In adding to its supply of gas, yesterday, demanded by the sharp weather, the Trust turned into its city system the flow from two or three new wells. While this was being done, the officers of the company state that they required their consumers on high-pressure mains to reduce their consumption. Among the establishments that for the time being, either in whole or part, returned to the use of coal were Kingan & Co., Acme mills, Hetherington & Berner, Sinker & Davis, Parrott & Taggart, Atlas works and Merritt & Coughlin. The officers of the Trust stated that there was no trouble with their low-pressure lines, and that the consumers named and others taking from the high pressure would be only temporarily embarrassed. Kingan & Co. were using gas altogether last night, and the Atlas works returned to that fuel early in the afternoon.

ABOUT TILE AND DRAINAGE.

The State Association Hears Interesting Papers on Those Topics and Adjourns.

Yesterday the Indiana tile and drainage convention closed its sessions. During the proceedings the Illinois visitors showed an especial interest in them, and gave some beneficial statements regarding the drainage laws of their State. In ditching, they said, the expense in Illinois is divided equally between the land-owners and the county, the Commissioners ordering the ditch constructed, upon the agreement of the parties along whose land it is to be run. There is hardly, if ever, any trouble in getting all parties to concur in the construction. There exists in several cities of Illinois streets paved with vitrified clay. About twenty thousand miles of tile is laid every year. In Indiana there are six hundred tile factories, and during the last ten years there has been laid annually an average of thirteen thousand miles of tile. Ohio's average is the same as that of this State. In Iowa the average is six thousand miles a year, and in Michigan eight thousand. It is claimed that the best results in building roads are obtained by placing tile ditches along one side of the road. This system has been experimented with in some parts of Illinois and found to be very successful.

Mr. Alter, in his paper, yesterday, on "Quality and Size," stated that color is a poor guide to determine quality of tile or brick. Owing to the rapid burning of clay in the present age the rule of color cannot be relied upon. The test now employed is the ring of the tile when struck by a hard substance. If it is not clear the sound betrays weakness. There is much ground of experiment in regard to size. If the drainage districts were uniform in lay of surface, general rules in size might be formulated. Only through close observance can the proper size be determined.

The drainage of boggy land was discussed by W. M. Whitten, of South Bend. To effectually drain such lands, he said, it is necessary to remove the water, if there be any, from the surface, and the water from the soil, to a depth sufficient for the growth of cultivated crops. Assuming that an outlet can be obtained, the drainage of surface water from boggy lands requires the same treatment as in the removal of surface water from other lands. It is only in the drainage of the water in the soil that boggy lands may require different methods. In those swamps in which the muck rests upon clay, hardpan or other impervious material, preventing the rise of water from any underlying water-bearing strata, the drainage is accomplished by the same process as in other land, except that fewer drains are required on account of the porous nature of the soil. The swamps most difficult to drain are those in which the muck rests upon sand, gravel or other porous material which forms a part of a water-bearing stratum. If sufficient outlet can be obtained these bogs may be drained. Anything that will sufficiently reduce the head in the water-bearing strata or intercept the flow to the bog will drain it to such an extent as to render it susceptible of ordinary drainage. If this head can be reduced or the flow so cut that the water in the sand or gravel upon which the muck rests will stand below the point to which drainage of the soil is desirable, it will be effected without any further work, for the porous stratum will then act in the capacity of an under-ground drain. In case the porous stratum is underlaid by one of impervious material, open drains will be found impracticable and tile drains hard to construct on account of the water encountered. The laying of tile in sand or gravel several feet below the water is accomplished by movable iron boxes, which, when properly constructed, makes the drainage of such lands a success.

To get the farmers interested in this kind of work L. E. Mace said it will be first necessary to make nothing but first-class tile. The tile manufacturer should not only be a maker, but an educator in the uses and benefits of tile drainage, the manner of laying them, and the average profits gained from draining.

One of the most interesting papers of the session was read by E. M. Pike, of Chenoa, Ill. His subject was "Burning." There were several requisites, he said, to the perfect burning of a kiln of any kind of ware. The ware should first go into the kiln as nearly dry as possible and be properly set. If of drain tile or sewer pipe, they should be nested so that two sizes should intervene, that is a five inch should be placed in an eight inch, and so on. If any difference the top part of the kiln should be left open. In all cases the kiln should be set so that the opening in the wares shall be alike, so as to insure an equal draft in all its parts. There are two processes of burning. Water smoking and burning proper. Water-smoking is the process of draining off the water and is of as much importance as the burning itself. Time enough should be taken to get off all the dampness. The kiln should be fired regularly and all drafts should be kept open to the stack, and when the dampness is nearly off the fire should be increased gradually. Green ware should not be put in with dry, for both will suffer, the moisture from the green being taken up by the dry, and if fired too strongly before the dampness is off the result will be "white-washing." To drive out all moisture a heat of 212 deg. Fah. is required, and its exit cannot be hurried except at the expense of the quality of the ware.

The second process, burning proper or driving off the water chemically combined with the clay, which requires a heat of over 1,000 degrees F. When the moisture is gone the heat should be increased, until the silica or sand fuses and partially melts together. Kilns remaining any length of time idle should be dried out.

With this paper the session went into the election for officers as follows: President, J. J. W. Billingsley; vice-president, W. B. Gill; secretary, Mr. Randall, all of this city; treasurer, Mr. Lee, of Crawfordsville. Resolutions were adopted to appoint a committee to wait upon the members of the Legislature and urge that an appropriation should be made for the establishment of farmer's institutes in different parts of the State.

Manufacturers Petition for Free Copper.

NEW YORK, Dec. 12.—The annual meeting of the Manufacturers' Association of Brass and Iron, Gas and Water-works was held this afternoon at the Fifth-avenue Hotel. A committee was appointed to go to Washington, after consultation with manufacturers, and present to the committee on the tariff a petition asking for the removal of the duty on ingot and manufactured copper. The committee are G. T. Coppings, of Boston; C. E. Pease, Dayton, O.; Jas. Powell, Cincinnati; Charles Garecki, Erie, Pa.; A. T. Foster and S. L. Morrison, of New York. The following were elected officers: President, A. T. Foster; vice-presidents, G. T. Coppings, John Pierce and Charles Harrison; treasurer, John M. Peck; secretary, S. L. Morrison. Among the out-of-town people present were representatives of the following houses: Jareckim Manufacturing Company, Erie, Pa.; Wm. Powell Company, Cincinnati; David Creswell & Co., Denver; W. T. Garrett, San Francisco; Western Brass Manufacturing Company, St. Louis; Henry McShane, of Baltimore; Loraine (Ohio) Manufacturing Company; L. Wolff Manufacturing Company, Chicago.

The Next Preident of the B. & O.

BALTIMORE, Dec. 12.—The various rumors as to the proposed change of the executive officers of the Baltimore & Ohio railroad have resulted in the issuing of a statement by parties now in control of the board of directors. The statement is to the effect that the presidency of the road has been offered to Mr. Charles F. Mayer, that he has accepted it, and that he will be elected at the meeting of the directors on Dec. 19. How the vice-presidency will be filled is still undecided. The statement is considered evidence that the Garrett party are to have things their own way in the management of the road. At the recent meeting, it now transpires, resolutions were adopted to guarantee two new loans, one for about $300,000 and the other for $1,000,000.

Chief Colorow Dead.

DENVER, Col., Dec. 12.—Word reached here to-day from Ouray agency, that Colorow the celebrated chief of the Southern Utes, had died at the agency yesterday, of pneumonia. The red chief was the most famous in the West, and was the leader in the Meeker massacre, and also in the Colorow war in Garfield county, a year ago. Since this last outbreak he has been under military surveillance, which has greatly worried him. About a month ago he took a violent cold, which rapidly turned into pneumonia, resulting fatally yesterday. He was over seventy years of age, and will be succeded by Sapovanaro, chief of the Uncompahgres.

MET WITH WARM GREETINGS

Vice-President-Elect Morton and His Wife the Guests of General Harrison.

Scenes and Incidents Connected with Their Journey and Arrival Here—Various Entertainments Proposed in Their Honor.

Vice-president-elect Morton and wife arrived in this city last evening at 6 o'clock, coming on a special train over the Bee-line from Cleveland. The distinguished party left New York on Tuesday morning in a special car of President Chauncey Depew, of the New York Central road, and arrived in Cleveland early yesterday morning, remaining there until 10 A. M., when the car was attached to the special train which brought it here as above stated. There were few incidents of interest along the route.

At Muncie the train was boarded by one or two newspaper men from this city. Mr. Morton declined to talk politics, but he and Mrs. Morton shook hands with the people who gathered at the station and those who were at various points between that city and this. Mr. Morton expressed his pleasure at having the opportunity to meet Indiana friends.

When the train pulled into the Union Station a large number of people had assembled to see and greet the visitors, and the crowd contained many prominent representatives of business and professional interests here. Private Secretary E. W. Halford and Mr. J. R. McKee were in waiting as the personal representatives of General and Mrs. Harrison, and Mayor Denny, Wm. Scott, James A. Wildman and S. T. Bowen appeared as representatives of the Board of Trade. Beside these, many well known gentlemen, such as Judge E. B. Martindale, Hon. John C. New, Colonel Bridgland and others were on hand to welcome the visitors, and a numerous contingent of newspaper men swelled the crowd that filled up the approach to the train gates at the passenger entrances and exits. As the special car came under the electric lights, the tall figure and strongly-featured face of the Vice-president-elect was seen through the windows, and the crowd pressed forward to get a nearer view of him. The reception committees greeted the distinguished visitors, and, after them many citizens were presented to them and added their individual welcome.

As the reception in the rear apartment of the car went on, there was a good opportunity of observing General Harrison's associate on the Republican presidential ticket, and it was taken advantage of liberally. The campaign portraits did him scant justice, but they presented enough of his clear-cut features and keen expression to make him readily recognizable wherever Republican campaign banners floated and Republican badges were worn. He is much taller than the average, but his well-knit figure and trimly-fitting dark clothing removes the appearance of unusual height, and it is not noticeable until he stands up by the side of people of lesser stature. As he stood chatting at the car entrance Mrs. Morton, warmly clad in a blue traveling cloak trimmed with fur, and wearing a very becoming dark hat trimmed with ostrich plumes, came through the passage way and stood behind him, smiling pleasantly as she was greeted by those who were presented to her by her husband. Her pictures resemble her much less than Mr. Morton's counterfeit presentments resembles him, and it was the general impression among those who saw her at the depot that she does not look unlike Mrs. Harrison. She captured the admiration of the crowd to such an extent that its attention was largely diverted from her husband until the committee cleared a path to the carriages.

The visitors were escorted through the depot, and Mr. and Mrs. Morton, attended by Private Secretary Halford, and General Harrison's son-in-law, Mr. J. R. McKee, were driven direct to General Harrison's residence. The General met them at the door and greeted them warmly, and the welcome given them by other members of the family was equally hearty and cordial. At the dinner, which followed close upon their arrival, the only persons at the table beside Mr. and Mrs. Morton were General Harrison and his immediate family. Following the dinner the ladies returned to the parlors and the gentlemen adjourned to the library to smoke. Later in the evening quite a number of friends and neighbors came in to pay their respects, and the evening was pleasantly spent in social conversation, both Mr. and Mrs. Morton evidently enjoying the society into which they were thrown. Among the callers were Judge Woods, of the United States District Court, Dr. and Mrs. H. R. Allen, Mr. and Mrs. Haughey, Mr. and Mrs. Ransdell, Mr. and Mrs. R. O. Hawkins, Mr. and Mrs. Chapin Foster, Mrs. Kitchen, State Treasurer Lemcke, M. H. McKay and Chas. Martindale. The delegation from the Board of Trade, consisting of Mayor Denny and Messrs. Murphy, Wildman, Bowen and Scott, came to confer with the Vice-president-elect concerning a public reception which Indianians desire to give him in this city, and Mr. Morton expressed his thanks for the intended courtesy, and asked leave to defer his reply until to-day.

After the callers had retired, the President and Vice-president-elect, sitting together on a sofa, talked of their participation in the national convention of 1880, and from this the conversation passed to the relation of political and personal recollections.

It is probable the reception, if given, will be held at the State Capitol, to-morrow evening, the entertainment to be given by Dr. and Mrs. H. R. Allen having been fixed for to-morrow afternoon. Other entertainments will be arranged in deference to the wishes of Mr. and Mrs. Morton, and with reference to the length of their stay in the city, which is not yet known.

Not Talking Politics Just Now.

CLEVELAND, O., Dec. 12.—Vice-president-elect Levi P. Morton was in Cleveland for a few hours this morning, but his arrival was so unexpected that but few other than the employes at the Union Depot were aware of it. He traveled in the private car of the New York Central & Hudson River railroad, attached to the Cleveland express which arrived here at 3 o'clock. His car remained here until 10 o'clock, when a special train was made up and the Vice-president-elect left for Indianapolis over the Bee-line. The distinguished traveler was accompanied by Mrs. Morton. They breakfasted at the Union Depot, and at 9 o'clock took a carriage for a short drive about the city. On their return from the drive, the Vice-president-elect was seen by a reporter at the depot. In reply to a request for an interview, Mr. Morton said:

"I am not talking politics just now. Mrs. Morton and I are now on our way to Indianapolis, where we will visit General and Mrs. Harrison."

"It is supposed that you will confer with General Harrison regarding the policy of the incoming administration, and especially about Cabinet appointments," suggested the interviewer."

"I have nothing to say on that point," replied the distinguished gentleman with a slight smile.

The Law Firm Dissolved.

Practically from the time of the national Republican convention began its session, General Harrison gave but little attention to the business of the firm with which he was then connected. When he did do so during the campaign it was only in consultation with his partners about cases that had begun long before he was named for the presidency. On the day of the election the firm of Harrison, Miller & Elam was dissolved, and since that time the General has had nothing whatever to do with its business or affairs. The firm is now Miller & Elam.